

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 March 2001 (01.03.2001)

PCT

(10) International Publication Number
WO 01/14696 A1

(51) International Patent Classification⁷: F01N 3/021,
3/023, 3/025

(21) International Application Number: PCT/EP00/07420

(22) International Filing Date: 31 July 2000 (31.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
99202673.2 19 August 1999 (19.08.1999) EP

(71) Applicant (for all designated States except US): N.V.
BEKAERT S.A. [BE/BE]; D.I.E. - 4011, Bekaertstraat 2,
B-8550 Zwevegem (BE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): MARRECAU, Willy
[US/US]; 37, Huntington Road, Rome, GA 30165 (US).

(74) Agent: MESSELY, Marc; D.I.E. 4011, Bekaertstraat 2,
B-8550 Zwevegem (BE).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

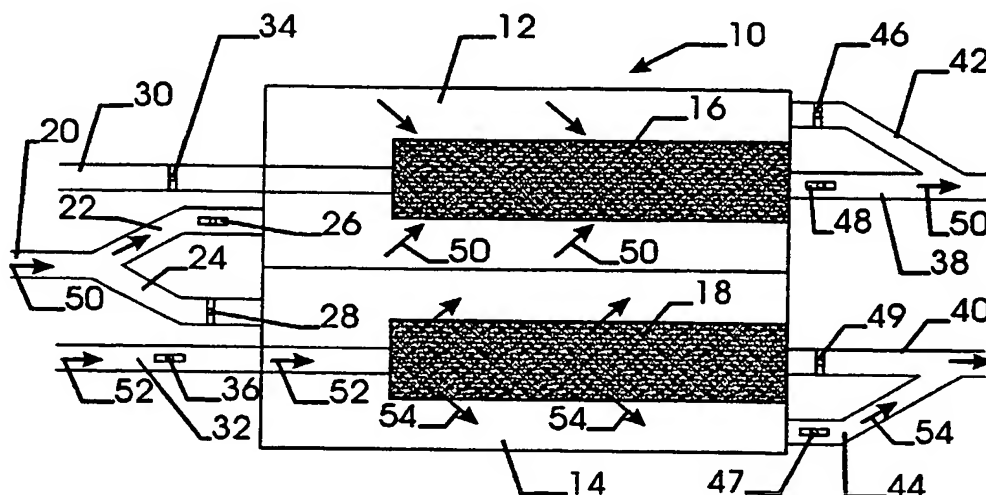
(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DIESEL EXHAUST PARTICULATE FILTER SYSTEM



(57) Abstract: A method is provided for regenerating a filter of a diesel exhaust particulate filter system (10). The method comprises as steps: a) providing at least one porous membrane (16, 18); b) using said membrane (16, 18) as filter during a filtration period; c) using said membrane (16, 18) as a surface combustion burner membrane during a regeneration period.

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DIESEL EXHAUST PARTICULATE FILTER SYSTEM**Field of the invention.**

5 The present invention relates to a method of regenerating the filter or the filters of a diesel exhaust particulate filter system.

Background of the invention.

10 As legislation with respect to environmental issues is becoming more and more severe, diesel exhaust particulate filter systems are more and more applied in the exhaust pipes of diesel engines to trap the particulates present in the diesel exhaust gases. As particulate matter is building up on the filter membrane, pressure drop increases until a threshold is reached. The determining factor to set the threshold is to safeguard the normal functioning of the diesel engine.

15 Some existing filter systems allow regeneration so that they can be used again during a subsequent period. The regeneration mainly constitutes in burning the trapped particulate matter present in the filters. This regeneration can be basically done in two ways.

20 One way is an electrical regeneration where the filter material is heated in an electrical way until above the ignition temperature of the particulate matter. Another way is the installation of a burner which generates a flame which reaches until the filter material to burn all present particulate matter.

25 Both ways, however, have their respective disadvantages. Apart from disadvantage caused by the unavoidable presence of electrical contacts and necessary electrical insulation means, the main disadvantage of the electrical regeneration system is that it involves a high degree of electrical power, which may cause substantial charge losses to the vehicle battery and which increases the consumption of fuel.

30 A disadvantage of the burner regeneration is that flames are generated in the exhaust pipes, which causes mechanical stresses and corrosion. Other disadvantages are that such burner regeneration systems require complex, large size and expensive combustion chambers with a high energy consumption and a high maintenance cost.

35

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Summary of the invention.

It is an object of the present invention to avoid the disadvantages of the prior art.

It is another object of the present invention to provide an efficient,
5 compact and inexpensive regeneration system for diesel exhaust filters.
It is also an object of the present invention to provide a regeneration system for diesel exhaust filters which consumes only a low amount of energy.

10 According to a first aspect of the invention, there is provided a method of regenerating a filter of a diesel exhaust particulate filter system. The method comprises as steps :

- a) providing a porous membrane ;
- b) using the membrane as filter during a filtration period ;
- 15 c) using the membrane as a surface combustion burner membrane during a regeneration period which follows the filtration period.

The use of a porous membrane both as filter membrane and as surface
20 combustion membrane makes the system very efficient, compact and inexpensive.

According to a second and preferable aspect of the present invention, there is provided a method of regenerating a diesel exhaust particulate filter system, wherein following steps are occurring :

- 25 a) providing at least two porous membranes ;
- b) using at least one of said membranes as filter during a filtration period ;
- c) using at least one of the remaining membranes as a surface combustion burner membrane during a regeneration period
- 30 which overlaps with said filtration period.

In comparison with the embodiment of the first aspect where the regeneration period follows the filtration period, this embodiment allows regeneration to be done during the operation of the filter system.

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The porous membrane can be made out of a suitable heat and corrosion resistant material such as a ceramic material or a stainless steel. Preferably the membrane is made of a stainless steel fiber web which is sintered.

5 Suitable stainless steel alloys are Fe-Cr-Al alloys.

A first group of Fe-Cr-Al based alloys comprises 15 to 25 % Cr and 4 to 6 % Al. Preferably the Al content is between 4.8 and 5.7 %.

A preferred alloy composition is an Fe-Cr-Al based alloy further comprising Y. This alloy is known as Fecralloy®.

10 The Y content ranges from 0.03 to 0.5 % and is preferably between 0.08 and 0.35 %. Most preferably the Y content is between 0.25 and 0.35 %. Another possible alloy composition is an Fe-Cr-Al based alloy which further comprises at least one additional element selected from the group consisting of Sc, Y, Ti, Zr, Hf, V, Nb, Ta and the lanthanides, for example La or Ce. The content of the additional element or the sum of the additional elements is between 0.01 and 1%.

15 A second group of Fe-Cr-Al based alloys comprises up to 15 % Cr and 20 to 60 % Al. These alloys further comprise at least one additional element selected from the group consisting of Sc, Y, Ti, Zr, Hf, V, Nb, Ta and the lanthanides.

Fiber diameter, amount of fiber in weight per square meter and porosity are determined in function of :

- 25 1) the filter rating so that very fine particulate matter can be captured ;
2) the dirt holding capacity so that the frequency of regeneration can be kept to a minimum.

A typical example of a suitable fiber medium is a fiber diameter of 22 μm and a weight of 1050 g/m².

30 During the regeneration period or cycle the stainless steel fiber web responds very quickly due to its small thermal mass and keeps the regeneration period to a strict minimum. As a consequence, the energy consumption during the regeneration cycle is also kept as small as possible.

During the regeneration period fuel is provided to the stainless steel fiber web. This fuel is preferably diesel as this is readily available. The diesel is preheated by the heat of the warm air coming from the engine and used as combustion air. By preheating the diesel is vaporized and after ignition beyond the membrane, combustion occurs in radiant mode. So, apart from the soot particulate matter, the only mass which needs heating up is the stainless steel fiber web, which has a low thermal mass due to the small diameter fibers and their great number of mutual contacts. This explains the short regeneration cycles or periods and the low energy consumption.

Combustion occurs then in radiant mode at the surface of the stainless steel fiber web. So no separate burner is required to heat up the stainless steel fiber web.

Another phenomenon which helps to reduce the energy consumption is as follows. The combustion of the particulate matter present in the stainless steel fiber web is an exothermic reaction, which, once initiated, keeps burning even after gradually reducing the diesel input.

According to an advantageous embodiment of the present invention, the method comprises the step of monitoring the pressure drop across the porous membrane during the filtration period. As particulate matter is building up at the surface of said membrane and in the membrane, this pressure drop increases during filtration. Once the pressure drop across the membrane reaches the threshold, which is checked automatically using a pressure gauge, the filtration period or cycle stops and the regeneration period or cycle starts.

Brief description of the drawings.

The invention will now be described into more detail with reference to the accompanying drawings wherein

- 5 - FIGURE 1 schematically shows the functioning of a diesel exhaust particulate filter system according to the second aspect of the invention.

10 **Description of the preferred embodiments of the invention.**

FIGURE 1 schematically shows the functioning of a diesel exhaust particulate filter system 10 according to the second aspect of the invention, where filtration and regeneration may occur in parallel. The diesel exhaust particulate filter system comprises at least two
15 modules 12, 14 which are placed in parallel. Each module 12, 14 comprises a stainless steel fiber web 16, 18. This stainless steel fiber web is present in the form of a cylinder. Other forms, such as planar strips, are also possible. The diesel exhaust gases are guided via pipe 20 which at its end splits up into two separate inlet pipes 22, 24 leading
20 resp. to module 12 and module 14. Valve 26 in inlet pipe 22 and valve 28 in inlet pipe 24 control the flow of the exhaust gases. The diesel fuel can be injected via inlet pipe 30 to module 12 and via inlet pipe 32 to module 14. Valve 34 in inlet pipe 30 and valve 36 in inlet pipe 32 control the flow of the diesel fuel. Exit pipes 38 and 40, resp. for modules 12
25 and 14, guide the filtered exhaust gases away from the diesel engine. Exit pipes 42 and 44, resp. for modules 12 and 14, guide the burner gases away from the diesel engine. Valves 46, 47, 48 and 49 control the flow.

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In the situation as shown in FIGURE 1, modul 12 functions as filter whereas module 14 is being regenerated. Valve 28 is in a closed position and thus prevents the exhaust gases 50 from flowing to module 14. Valve 26 is in open position and allows the exhaust gases 50 to
5 module 12. Valve 34 is in closed position, so no diesel is injected into module 12. The flow of exhaust gases 50 is radially inwards in the stainless steel fiber web cylinder 16 (as pointed out by the arrows). As particulate matter is building up at the radially outer surface of the steel fiber web cylinder 16, the pressure drop over the steel fiber web
10 increases. This pressure drop is sensed by means of a pressure gauge which is positioned downstream (not shown). Once a predetermined critical level is passed, signals are given to the respective valves to have module 12 operated in regeneration mode and module 14 in filter mode.

15 The filtered exhaust gases are axially guided away from the diesel engine via exit pipe 38 and valve.

In the meantime, valve 36 is in open position and allows diesel to be injected into module 14. The diesel fuel 52 is heated by the present warm air coming from the engine and is ignited. Any particulate matter
20 present on stainless steel fiber web 18 is burned away and the thus created exhaust gases 54 are led away via valve 47 and exit pipe 44. A flame is only present on the surface of steel fiber web 18. No flames are present in the various pipes.

25 The diesel exhaust particulate filter system can be mounted on diesel motors for vehicles as well as for diesel motors functioning outside vehicles such as in stand-alone electrical generation systems.

CLAIMS

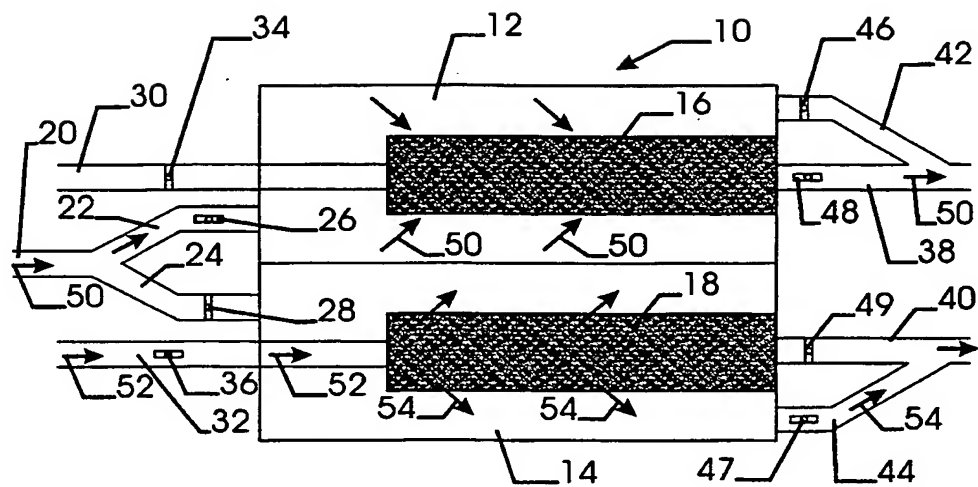
- 5
- 1) A method of regenerating a filter of a diesel exhaust particulate filter system, said method comprising as steps :
- a) providing a porous membrane ;
 - b) using said membrane as filter during a filtration period ;
 - c) using said membrane as a surface combustion burner membrane during a regeneration period following said filtration period.
- 10
- 2) A method of regenerating a diesel exhaust particulate filter system
- a) providing at least two porous membranes ;
 - b) using at least one of said membranes as filter during a filtration period ;
 - 15 c) using at least one of the remaining membranes as a surface combustion burner membrane during a regeneration period which overlaps with said filtration period.
- 20
- 3) A method according to claim 1 or 2, wherein said membrane is a stainless steel fiber web.
- 25
- 4) A method according to any of the preceding claims, said method comprising the step of providing fuel to said membrane during the regeneration period.
- 30
- 5) A method according to claim 4 wherein said fluid fuel is diesel.
- 6) A method according to any of the preceding claims, said method further comprising the step of :
- monitoring the pressure across said membrane during the filtration period.

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7. A method according to claim 6, said method further comprising the step of :

- generating a control signal to regenerate said membrane, once the pressure across said membrane exceeds a predetermined level.

8. A method according to claim 4 wherein during said regeneration period the amount of fuel provided is reduced after initiation of a flame at said porous membranes.

Fig. 1

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 4733/MM	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 00/ 07420	International filing date (day/month/year) 31/07/2000	(Earliest) Priority Date (day/month/year) 19/08/1999
Applicant N.V. BEKAERT S.A.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/07420

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F01N3/021 F01N3/023 F01N3/025

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 06814 A (MICROPYRETICS HEATERS INT ;GUPTA VIKAS (US); PENUMELLA SRINIVAS (U) 7 March 1996 (1996-03-07) figures 1,8 abstract page 11, line 11 - line 15 page 24	1,2
A	US 4. 535 588 A (SATO SUSUMU ET AL) 20 August 1985 (1985-08-20) figure 1 abstract column 4, line 13 - line 61 --- -/--	1,3-5

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

1 November 2000

Date of mailing of the international search report

08/11/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Wassenaar, G

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/07420

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 373 330 A (STARK TERRENCE L) 15 February 1983 (1983-02-15) figure 1 abstract column 2, line 64 -column 3, line 50 ---	1,2
A	US 4 871 495 A (HELPERICH RICHARD L ET AL) 3 October 1989 (1989-10-03) figure 1 abstract -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/07420

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9606814 A	07-03-1996	US 5590383 A US 5766458 A US 5558760 A US 5655212 A AU 2761695 A CA 2175377 A	31-12-1996 16-06-1998 24-09-1996 05-08-1997 22-03-1996 07-03-1996
US 4535588 A	20-08-1985	JP 56104111 A JP 56000509 A JP 56012045 A JP 56018016 A JP 56054914 A JP 56056921 A	19-08-1981 07-01-1981 05-02-1981 20-02-1981 15-05-1981 19-05-1981
US 4373330 A	15-02-1983	NONE	
US 4871495 A	03-10-1989	CA 1336582 A DE 3816893 A DE 3853002 D DE 3853002 T EP 0344284 A ES 2009421 A GB 2212799 A,B GB 2248833 A,B JP 2502374 T JP 2617362 B KR 9606252 B MX 169628 B WO 8905285 A US 4976760 A	08-08-1995 15-06-1989 23-03-1995 05-10-1995 06-12-1989 16-09-1989 02-08-1989 22-04-1992 02-08-1990 04-06-1997 11-05-1996 14-07-1993 15-06-1989 11-12-1990

PATENT COOPERATION TREATY


PCT

REC'D 27 NOV 2001

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference 4733/MM/cvb		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP00/07420	International filing date (day/month/year) 31/07/2000	Priority date (day/month/year) 19/08/1999	
International Patent Classification (IPC) or national classification and IPC F01N3/021			
Applicant N.V. BEKAERT S.A. et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none">I <input checked="" type="checkbox"/> Basis of the reportII <input type="checkbox"/> PriorityIII <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicabilityIV <input checked="" type="checkbox"/> Lack of unity of inventionV <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statementVI <input type="checkbox"/> Certain documents citedVII <input checked="" type="checkbox"/> Certain defects in the international applicationVIII <input type="checkbox"/> Certain observations on the international application			
Date of submission of the demand 05/03/2001		Date of completion of this report 22.11.2001	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Zebst, M Telephone No. +49 89 2399 7313	



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/07420

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
Description, pages:

1-6 as originally filed

Claims, No.:

1-8 as originally filed

Drawings, sheets:

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
4. The amendments have resulted in the cancellation of:
- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/07420

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
☐ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
☒ not complied with for the following reasons:
see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 3,8
	No:	Claims 1,2,4-7
Inventive step (IS)	Yes:	Claims
	No:	Claims 1-8

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP00/07420

Industrial applicability (IA) Yes: Claims 1-8
 No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/07420

Re Item IV

The two independent claims 1 and 2 are related to a method of regenerating a filter of a diesel particulate filter system.

The common concept linking together the independent claims 1 and 2 is the following:

- a) providing a porous membrane
- b) using said membrane as a filter during a filtration period

This common concept is not novel, see point V, 3.1.

The requisite unity of invention (Rule 13.1 PCT) therefore no longer exists inasmuch as a technical relationship involving one or more of the same or corresponding special technical features in the sense of Rule 13.2 PCT does not exist between the subject-matter of the dependent claims 1 and 2.

Re Item V

1. The industrial applicability of the invention seems to be self-evident (Article 33(4) PCT).
2. Reference is made to the following documents:
D1: US-A-4535588
D2: WO-A-9606814

3. Claim 1

All the features of this claim are generally known from the person skilled in the art and have already been employed for the same purpose in a similar filter device, see document D1, column 3, lines 24 to 36 (see figure 2):

Document D1 shows:

a method of regenerating a filter of a diesel exhaust particulate filter system (4A,4B), said method comprising as steps: a) providing a porous membrane (8); b) using said membrane (8) as filter during a filtration period ; c) using said membrane (8) as a surface combustion burner membrane during a regeneration period following said filtration period.

The subject-matter of claim 1 is therefore not novel (Article 33(2) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/07420

4. Claim 2

Document D1 shows:

a method of regenerating a diesel exhaust particulate filter system (4A,4B), said method comprising as steps
a) providing at least two porous membranes (8);
b) using at least one of said membranes (8) as filter during a filtration period;
c) using at least one of the remaining membranes (8) as a surface combustion burner membrane during a regeneration period which overlaps with said filtration period: see column 7, lines 29 to 51; figure 8

It is to be noticed that due the position of the "valve (74)", one "cleaning device (4A,4B)" is acting as a filter while the remaining "cleaning device (4A,4B)" is regenerated.

During the regeneration period, fuel is flowing into the cleaning device to be regenerated and the carbon particulates caught and collected by the filter are burnt: the features "*using at least one of the remaining membranes as a surface combustion burner membrane during a regeneration period*" are therefore implicitly known from D1.

All the features of claim 2 are known from D1: the subject-matter of this claim is therefore not new (Article 33(2) PCT).

4. Dependent claims

Dependent claims 3 to 8 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows:

4.1. The features of claim 3 are known from D2: see page 24, lines 6 to 14.

4.2. The features of the claims 4 to 7 are known from D1: see column 6, lines 4 to 8; column 7, lines 18 to 22 and lines 31 to 35

4.3. Dependent claim 8 merely seems to contain a simple constructional detail which comes within the scope of the customary practice followed by a skilled person.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/07420

Re Item VII

1. The features of the claims **1** to **8** are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.